

centre of figure ; and we cannot but regret that, owing to the sudden interruption which now fell upon his scientific life, that work of which we have but the introduction was never finished, and the many interesting facts as to the changes which had taken place in historic times in Southern Italy were never recorded, and the many curious disquisitions we were led to anticipate are lost for ever.

In 1668 Christian V. offered Steno the Chair of Anatomy at Copenhagen, which he accepted, and entered upon the duties of his office with the delivery of a remarkable inaugural address pointing out the direct benefits that have been derived from the study of anatomy, not only in the alleviation of suffering in others, but from the pleasure of the intellectual pursuit itself. But though his talent was universally recognised, jealousy and bigotry combined to make it uncomfortable for him in his native place, and so he returned to Tuscany, where the Grand-Duke Cosmo III. intrusted to him the education of his son Ferdinand. Steno now began to turn his attention to religious questions, and gave up natural science. He thought he must endeavour to bring about the conversion of his old co-religionists, and wrote several theological works which involved him in a controversy with the reformed clergy of Jena. Innocent XI. rewarded his zeal by appointing him, in 1677, Bishop of Titopolis (*in partibus*), and Apostolic Vicar of Northern Europe.

Steno fixed his residence in Hanover, when the Duke John Frederick of Brunswick had just embraced the Catholic faith ; but on the death of this prince in 1679, the electorate fell under the domination of the Bishop of Osnabruck, who belonged to the reformed communion, and would not allow any proselytising to go on in his states. Steno therefore had to leave ; and after spending some time at Munster and Hamburg, withdrew to Schwerin, where he died November 25, 1687. His body was, at the request of the Grand-Duke Cosmo III., carried back to Tuscany and laid in the Basilica of S. Lorenzo.

A simple slab of marble, put up by the Catholics whose cause he had espoused, marks the spot. The inscription gracefully records the pious prelate's end. As far as we know, no relative stood by¹—no man of science pronounced a eulogy over Steno's grave.

The epitaph runs thus :—

NICOLAI STENONIS
EPISCOPI TITOPOLITANI
VIRI DEO PLENI
QUIDQUID MORTALE FUIT HIC SITUM EST
DANIA GENUIT HETERODOXUM
ETRURIA ORTHODOXUM
ROMA
VIRTUTE PROBATUM SACRIS INFULIS INSIGNIVIT
SAXONIA INFERIOR
FORTEM EVANGELII ASSERTOREM AGNOVIT
DEMUM
DIUTURNIS PRO CHRISTO LABORIBUS AERUMNISQUE
CONFECTUM
SVERINUM DESIDERAVIT
ECCLESIA DEFLEVIT
FLORENTIA SIBI RESTITUIT
SALTEM IN CINERIBUS VOLUIT
A.D. 1687

In this epitaph nothing is said of what Steno did for science, and when the President of the International Geological Congress led the congressists from Bologna to Florence last autumn to place a wreath upon the tomb of Steno, and called upon the distinguished Danish antiquary, Waldemar Schmidt, to say a few words to those assembled round the last resting-place of his illustrious compatriot, it was felt that it would be a fit and

pleasing thing to put another slab beside the old one, in memory of that gathering round his grave, and telling of the full appreciation of his worth as a man of science by those who came two centuries after him.

THOS. MCKENNY HUGHES

WIND MEASUREMENTS

SINCE the time of Hooke the accurate measurement of the wind has formed an object of experimental research. That philosopher, if not actually the first to invent an anemometer, at any rate appears to have been the first to write upon the subject, which since then has occupied the attention and exercised the ingenuity of many scientific men. The main result of these efforts was well shown last week at the exhibition of anemometers organised by the Meteorological Society. The President, in an interesting historical address, stated that the number which had been invented was at least one hundred and fifty, and upwards of forty of these were collected, besides photographs and drawings of many others. The exhibition was by kind permission held in the library of the Institution of Civil Engineers, at whose weekly meeting two papers, on the design of structures to resist wind, and the resistance of viaducts to gusts of wind, were very opportunely read.

It is not by any means generally recognised that there are two distinct objects for which the measurement of the wind is necessary ; these are : (1) the determination of the actual motion or transference of the air itself ; (2) the investigation of the effect of the wind. The two societies above mentioned well represent these two objects of anemometry, and all the instruments are included in one or other of the two classes, which are said to measure respectively the velocity and pressure of the wind. These terms, though convenient, are slightly misleading, as it is really the impulse of the wind which is in both cases measured—in one by its effect in producing the continuous rotation of a vane or set of cups, in the other by its statical effect upon a pressure board or column of air or liquid.

From the nature of the wind it is evident that nothing less than a continuous graphic record could be of much service, and but little progress was made until the invention, about fifty years ago, of self-recording instruments of both classes. The late Dr. Robinson, F.R.S., contributed more than any one else to the establishment of the velocity anemometer which, by the addition of Mr. Beckley's self-recording apparatus, is undoubtedly a model of mechanical invention. Mr. Follet Osler, F.R.S., as the result of much persevering labour and skill, has given to the world a pressure instrument of great excellence, and of this and the former, both of which may be regarded as the best types of the two classes, it may fairly be said that much improvement, at any rate in mechanical construction, can hardly be expected.

As to the tabulation of results, this is conducted with the most scrupulous regularity. Since 1874 the Meteorological Office has published hourly numerical records, from its various stations, of the direction and other elements of the wind. Quarterly records containing engravings of the actual curves are also published. These latter have rather fallen into arrears, the first volume of the new series for 1876 having been only published in 1881 ; but it is satisfactory to hear that the work of completing them up to the year 1880 is progressing, and it is to be hoped that they will always be continued.

In the face of all this expenditure of time and skill the meteorologist and the engineer alike proclaim the unsatisfactory state of the science. The engineering aspect of the question, viz. the effect of the wind, has recently excited considerable attention in consequence of the Tay Bridge disaster in this country, and of similar accidents abroad. It is evident that with the increase in the size of engineering structures, particularly in exposed situa-

¹ Jacques-Benique Winslow, an illustrious name in the annals of anatomy, was descended from a sister of Steno, but otherwise we hear no more of his relations.

tions, the force of the wind may become as great as that impressed upon the structure by the action of gravity. The recent account, in this paper, of the proposed new Forth Bridge, was a good example of the provision made for wind pressure, not only on the completed structure, but also during its construction. Notwithstanding this, the report of the recent Commission on Wind Pressure substantiates the statements already alluded to. This distribution of wind pressure over any surface appears to be very little understood, though the matter is being carefully investigated by more than one experimenter, and some results have recently been published. It seems, however, hardly credible that the maximum pressure to which a structure may be exposed is almost as great a matter of uncertainty; yet such is the case. The papers on wind pressure, above referred to, in spite of the existence of so many anemometers, endeavour to ascertain from a variety of sources, such as previous accidents, and reports of the effect of wind in storms, what the probable maximum pressure has been, both, however, assuming values for purposes of calculation far less than are actually reported. In the same manner, the Commission decided upon a limiting value only a little more than 62 per cent. of a pressure recorded by an anemometer, and believed by them to have actually taken effect in this country.

The fact is, that the motion of the air is, beyond all expression, most complicated. Were it not for this, there would be no necessity for obtaining both the velocity and pressure of the wind, for there is, by a first principle of dynamics, a fixed relation between these two elements; and if one were known, the other could be, at any rate, approximately deduced. In reality, any attempt to treat the wind as having steady motion for more than a very small distance in space, is certain to involve serious error, and the complications which are introduced, from even slight disturbing causes, seen quite beyond the powers of investigation. The engineer is concerned both with prejudicial effect of the wind upon structures, and its useful effect upon wind-motors. In both these cases the conditions are such as to greatly interfere with the steady motion of the wind, and the effect due to locality must be estimated and allowed for. The meteorologist needs observations of the wind at all elevations, and as pointed out by Mr. Laughton in his address, particularly at higher ones, where, judging from the experience of aeronauts, the motion of the wind is nearly as complex as below. Until the motion of the wind is better understood, weather forecasts must be more or less unreliable, and what has been said with reference to the mechanical excellence of the present anemometers and the regular tabulation of results, must not lead to the idea that there is no room for improvement. On the contrary, there is yet much to be done in directions which can here be only briefly indicated.

First, there is great necessity for improvement in the lubrication of the instruments, especially of that portion recording direction, so that in viewing a weather chart of the *Times* it may be certain that in light winds the arrows really show the direction and not directly the opposite one. Such an error as this, perhaps from some distant station, causes whole columns of the bulky hourly records to be worse than useless.

Secondly, the reductions for the relative velocity of the wind and cups, if made at all, ought not to be made, as is at present the case, by a factor now well known as the result of much costly investigation, to be erroneous.

Lastly, the locality of anemometers should be more carefully selected, or at least taken more closely into account, in discussing the effect of wind in storms.

The importance of some reform in the matter of wind measurement is obvious, since it is only by continued observations, under improved conditions, that a more reliable and satisfactory knowledge can be obtained of the aerial ocean in which we live.

H. S. H. S.

THE ZOOLOGICAL SOCIETY AND "JUMBO"

AT the General Meeting of the Fellows of the Zoological Society on Thursday last, Prof. Flower made the following remarks with reference to the subject of the elephant, "Jumbo":—

Before the Meeting separates I wish to make a few observations upon the subjects which have just been under discussion. It has been said that there should be power in the Bye-laws to call Special Meetings of the Fellows of the Society; and the subject is certainly deserving of the consideration of the Council. The probable explanation why there is no such power already, lies in the fact that there are regular Monthly General Meetings at which all Fellows are able to be present, to ask any questions or to make any observations they think fit upon the management of the affairs of the Society and, upon notice having been given, to propose any resolutions.

With reference to the action of the Council in the particular case under consideration, their legal powers to part with any of the animals under their care have now been fully affirmed by Mr. Justice Chitty's judgment, and the expediency of their being able to exercise these powers at their discretion in all ordinary cases does not seem to be doubted by any sensible person. It has, however, been asserted that there was something exceptional in the case of the elephant in question. I would ask when, and by what means, can the line be drawn between an ordinary and exceptional animal? Two elephants have been sold within my recollection (one in 1854, the other in 1873), and no one ever disputed the power or discretion of the Council in parting with either. Certainly neither of them was called "Jumbo," a name which has clearly done much to foster the present agitation. If our "Jumbo" had been called by some name as unpronounceable as that of the two Indian elephants now in the Society's possession we should have heard much less of his virtues.

To speak of this animal as is done by Sir George Bowyer in the *Times* of to-day, as in any way comparable to the *Codex Alexandrinus*, is only equalled in absurdity by the statement lately made in a letter to the same paper by another Fellow of the Society, that if a certain Chancery suit were successful the animal would remain as a "permanent" inhabitant of the Gardens. How immortality was to be conferred on "Jumbo" I do not know. Our animals are only temporary possessions. All experience tells us that even elephants die, and, moreover, that whatever may be the case in their native land (a subject on which strangely exaggerated notions prevail), in this country they are never long-lived animals. Whatever means were tried to preserve "Jumbo," whether lawsuits, chains, or stone walls, it is absolutely certain that a few years would have seen his end in one way or another.

Then as to "Jumbo" being "unique," as is constantly said, I am not quite certain what is meant by this, as there are many African elephants at present in Europe, and one other in our own Gardens. As an elephant he is by no means perfect, wanting the most characteristic ornament of his race—the tusks. He is certainly large, but probably not larger than many other male elephants of his species would grow, if kept for a sufficient length of time. This very size, however, while in one sense adding to his value, is in another a serious detriment. It was, in fact, the principal cause of the desire to part with him. Then it is said that he was exceptional on account of his great money-value; but of what that value was no one could form any idea: in the general market it was literally nothing. I doubt whether, at all events a month ago, any one but the actual purchasers would have taken him off our hands at any price. I know, for my own part, so great has been my anxiety about him for several years past—so sure did I feel that he would one day or other bring us into trouble (although I can